

application.

Per the Examiner's request, this Amendment is responsive to the Office Action dated May 16, 2001 and the Supplemental Action dated June 27, 2001, wherein an initial due date for response of September 27, 2001 was set for both Actions, extendible to December 27, 2001.

In the Office Action dated May 16, 2001, claims 1, 3-13, 15-16 and 19-22 were rejected under 35 U.S.C. § 112, first and second paragraphs, for the reasons set forth at pages 2-7 of the Action. Similarly, in the Supplemental Action, claims 23-31 were rejected under 35 U.S.C. § 112, first paragraph, and claims 1, 3-13, 15-16 and 19-31 were rejected under 35 U.S.C. § 112, second paragraph, for the reasons set forth at pages 3-7.

Applicants respectfully traverse the foregoing rejections. However, in the interest of advancing the prosecution of the application, the claims have been amended as set forth herein in view of the Examiner's suggestions provided in the Actions and to further clarify the claimed invention. For example, Applicants have changed "lignocellulose-based, hexose-rich material" to - -lignocellulose-containing material- - and "wherein a majority of the starting material is processed" to - -substantially all of the starting material is utilized- -. Claim 11 has been amended to depend from claim 1 and claims 4 and 22 have been canceled without prejudice. In claim 21, "posthydrolysis" has been changed to - -followed by hydrolysis- -, as also suggested by the Examiner. Regarding the Examiner's objection to "decanting" in claim 23, Applicants respectfully direct the Examiner's attention to page 10, line 15 of Applicants' specification. Also, claim 31 is rewritten in independent form, in accordance with the Examiner's further suggestion.

In view of the foregoing, reconsideration and withdrawal of the rejections under 35 U.S.C. § 112 is respectfully requested.

It is also respectfully noted that Applicants' amendments and claim cancellations set forth herein do not constitute in any way an admission that the subject matter of these claims prior to amendment or cancellation was believed to be unpatentable.

In the Action of May 16, 2001, claims 1, 3-10, 12-13, 15-16 and 19-21 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,081,026 to Heikkila et al. ("Heikkila"). Claims 1, 3-13, 15-16 and 19-22 were then rejected under 35 U.S.C. § 103(a) as being obvious over Heikkila in view of newly cited U.S. Patent 5,047,332 to Chahal ("Chahal"). These claims were also rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-28 of Heikkila in view of Chahal.

Similarly, in the Supplemental Action of June 27, 2001, claims 23-30 were rejected under 35 U.S.C. § 102(b) as being anticipated by Heikkila and claims 23-31 were rejected under 35 U.S.C. § 103(a) as being obvious over Heikkila in view of Chahal. Lastly, these claims were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-28 of Heikkila in view of Chahal.

Applicants respectfully traverse the foregoing rejections for at least the following reasons.

It is respectfully asserted that neither Heikkila nor Chahal is applicable as a § 102(b) prior art reference against the present application. That is, Chahal and Heikkila have issue dates of September 10, 1991 and January 14, 1992, respectively. Under 35 U.S.C. § 102(b), a person shall be entitled to a patent unless the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The filing date of a foreign priority document is not the effective filing date of

a U.S. application, although the filing date of the foreign priority document may be used to overcome certain references under, for example, 35 U.S.C. §§ 102 (a) and (e), but not § 102(b). *See e.g.*, MPEP § 706.02(a)-(b). Also, the filing date of a national stage application filed under 35 U.S.C. § 371 is the international filing date of the PCT application. *See, e.g.*, MPEP § 1896.

On July 14, 1992, applicants filed a request for entry into the national stage in the United States under 35 U.S.C. § 371 claiming a foreign priority date of January 15, 1990 and identifying the international filing date of January 10, 1991 for PCT/FI91/00011. A national stage application filed under 35 U.S.C. § 371 need not claim benefit of the filing date of the international application of which it is the national phase because its filing date is the date of filing of that international application. *See* MPEP § 1893.03(b)-(c).

In view of the foregoing, the earliest U.S. filing date of the subject application appears to be January 10, 1991. Accordingly, newly cited Chahal, having an issue date of September 10, 1991, is not prior art under 35 U.S.C. § 102(b). Moreover, Applicants' filing date of January 10, 1991 (as well as Applicants' foreign priority date of January 15, 1990) is also prior to the patent date of Chahal and, thus, Chahal is not a proper prior art reference under 35 U.S.C. § 102(a).

Applicants respectfully note that the Examiner has previously acknowledged their claim for priority under § 119 and has also acknowledged receipt of the certified copy of the priority document (*see*, 3/14/95 Action in parent ser. no. 07/910,133). Accordingly, Applicants herein restate their claim to foreign priority under 35 U.S.C. § 119 based on FI 900220 filed in Finland on January 15, 1990. If required by the Examiner, Applicants will submit an English translation of the priority document, including a statement that the translation of the certified copy is accurate.

Regarding the Heikkila reference, since the issue date of this reference (January 14, 1992) is after the earliest effective U.S. filing date of the subject application (January 10, 1991), Heikkila is not a proper prior art reference under 35 U.S.C. § 102(b). Nor is Heikkila applicable as a prior art reference under § 102(a) because, for example, Applicants' filing date of January 10, 1991 (as well as Applicants' foreign priority date of January 15, 1990) is also prior to the patent date of Heikkila (January 14, 1992).

Moreover, Applicants respectfully assert that the present claims are not even anticipated by either Heikkila or Chahal, nor rendered obvious by either reference under § 103 or the judicially created doctrine of obviousness-type double patenting whether the references are view alone or in combination, for at least the following reasons. Each of Applicants' claims directly or indirectly include the limitation that substantially all of the starting material is utilized, as suggested by the Examiner.

In contrast to the primary reference, Heikkila, and as disclosed in Applicants' specification at page 3, in the process of Heikkila, the majority of the raw material is lost as a worthless waste material. If a greater part of the raw material could be converted to commercial products, this would essentially improve the economy of the overall process. Accordingly, Applicants have developed a process which overcomes this problem, the details and advantages of which are set forth in the specification. For example, Applicants have developed a process in which xylitol and ethanol can be produced simultaneously. According to Applicants' process, xylose is converted to xylitol, while the majority of the other hexoses present in the raw material are converted to ethanol. Thus, the raw material is effectively utilized and two commercially significant products are obtained in pure form and with a high yield (Specification, page 3, lines 24-32).

Additionally, laborious and complex separation steps (such as the

conventional ion exchange, demineralization, precipitations, etc.) are not needed as a result of the present invention. Generally, the xylitol can be purified in a single step chromatographically, whereafter it is crystallized to obtain pure xylitol. Ethanol is easy to remove from the fermentation solution, for example, by evaporation. Thus, the need for separating xylitol from the hexitols and other sugars produced in the hydrolysis and reduction steps is avoided. The hydrolysis performed in accordance with the present invention also provides a solution to the problem of pulp discarded as waste mass in other processes, and thus in Applicants' process, *substantially the entire starting material is utilized* (Specification, page 4, lines 9-23, emphasis added). Such an advantageous process is not disclosed in, nor rendered obvious by, Heikkila, which appears to even teach away from the presently claimed invention. Applicants further respectfully assert that the addition of the secondary reference Chahal, disclosing production of ethanol, does not render Applicants' present claims obvious.

In furtherance to the above, the Examiner requests additional information regarding publication dates of certain references provided to the Patent Office in Applicants' previously submitted information disclosure statements (*See*, page 11 of May 16, 2001 Action and page 2 of June 27, 2001 Action). Applicants have reviewed these documents and respectfully provide the following information. The submitted IPER for PCT/FI91/00011 (which is the corresponding international application of the subject application) has a completion date of April 10, 1992 indicated thereon and the Action for FI 900220 (which is the Finnish priority application of the subject application) has a date of October 30, 1990 indicated thereon. The International Search Report has a mailing date of April 27, 1990 and the Horitsu Japanese patent abstract appears to refer to a patent date of 880913 (September 13, 1988) for JP 63219386. Applicants further respectfully note that the Horitsu abstract

provided to the Office appears to be a better copy of the additional Japanese abstract provided to the Office and entitled on the 1449 form as "treating mixed sugar soln....". Applicants further respectfully note that, due to the nature of some of the foregoing documents, they may not have formal "publication dates."

In view of the amendments and remarks set forth herein, the subject application is believed to be in condition for allowance. Accordingly, a Notice of Allowance is respectfully requested. The Examiner is invited to contact the undersigned attorney at 212-425-7200 should he have any questions or wish to discuss this matter.

Respectfully submitted,



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Marked-up Version Showing Changes Made  
By The Present Amendment (37 C.F.R. § 1.121)

**In the Claims:**

1. (Amended) A process for the simultaneous production of xylitol and ethanol from a starting material of hydrolyzed [lignocellulose-based, hexose-rich] lignocellulose-containing material, comprising fermenting said hydrolyzed [lignocellulose-based, hexose rich] lignocellulose-containing material with a yeast strain which is capable of converting free xylose to xylitol and free hexose present to ethanol to form a fermented product comprising xylitol, ethanol and yeast, recovering the resulting ethanol and chromatographically separating a [xylitol-rich] xylitol-containing fraction from the remaining fermented product, and recovering xylitol from said [xylitol-rich] xylitol-containing fraction, wherein substantially all of the starting material is utilized [a majority of starting material is processed].

3. (Amended) The process according to Claim 1, wherein said [lignocellulose-based, hexose-rich] lignocellulose-containing material is birch or grain hulls.

Cancel Claim 4 without prejudice.

5. (Amended) The process according to Claim 1, further comprising crystallizing pure xylitol from the [xylitol-rich] xylitol-containing fraction obtained in the chromatography step.

11. (Amended) The process according to Claim [22] 1, wherein <sup>the lignocellulose-containing material</sup> ~~hydrolysis is carried~~  
out by steam explosion and enzymatic hydrolysis.

21. (Amended) The process according to [claim] Claim 1 wherein the [lignocellulose-based, hexose-rich] lignocellulose-containing material is treated by steam explosion [and posthydrolysis] followed by hydrolysis.

Cancel claim 22 without prejudice.

23. (Amended) A process for the simultaneous production of xylitol and ethanol from a hydrolyzed starting material of [method of processing] lignocellulose-containing material selected from the group consisting of softwood, birch, beech, poplar, alder, plants, plant constituents, straw, hulls of wheat, corn, oat, barley, corn cobs, corn stems, nutshells, bagasse, cottonseed bran, wood chips, sawdust, sulphite spent liquor from woodpulp processing, waste from paper processing, waste from woodpulp processing

[comprising xylose and hexose from a xylan-containing matter selected from the group consisting of: wood, softwood, hardwood as birch, beech, poplar and alder, plants, plant constituents as grain straw and grain hulls as wheat, corn, oat and barley, corn cobs, corn stems, nutshells, bagasse, cottonseed bran, wood chips, sawdust, woodpulp, spent sulphite liquor, spent liquor from paper processing, spent liquor from woodpulp processing, sulphite cooking liquor, and liquids derived from any of the preceding], comprising:

[processing] fermenting said hydrolyzed lignocellulose-containing material [to produce a xylose-rich solution comprising free xylose and hexose;

fermenting said xylose-rich solution] to produce a fermented solution with a



yeast capable of converting free xylose present to xylitol and free hexose present to ethanol,  
said yeast selected from the group consisting of a yeast of the genera *Candida*, *Pichia*,  
*Pachysolen*, and *Debaryomyces*, said fermenting comprising reducing said free xylose to  
xylitol and reducing said hexose to ethanol, and said fermented solution comprising xylitol,  
ethanol, and spent yeast;

separating a substantial portion of said spent yeast from said fermented  
solution to produce a substantially clarified solution comprising ethanol and xylitol, said  
clarified solution comprising substantially less spent yeast by weight on a dry solids  
(substance) basis <sup>than</sup> that said spent yeast in said fermented solution, and said separating  
comprising at least one separating method selected from group consisting of [clarification by  
e.g.] filtration, centrifugation and decanting;

[distilling said clarified solution to produce distilled ethanol and xylitol  
distillate, said distilled ethanol comprising a greater concentration of ethanol by weight on a  
liquid basis than said ethanol in said clarified solution, and said xylitol distillate comprising a  
greater concentration of xylitol by weight on a dry solids basis than said clarified solution]

recovering ethanol by distillation;

recovering xylitol by chromatographic separation;

[fractionating said xylitol distillate by chromatographic separation to produce a  
xylitol fraction and a residue fraction, said xylitol fraction comprising a greater concentration  
of xylitol by weight on a dry solids basis than said xylitol in said xylitol distillate;] and

crystallizing said xylitol [fraction] to produce xylitol crystals; wherein  
substantially all of the starting material is utilized.

24. (Amended) A method according to Claim 23 wherein [processing of said

lignocellulose-containing material] hydrolysis comprises at least one of the following: i) prehydrolysis of said lignocellulose-containing material[,] by steam explosion of said lignocellulose-containing material[,] and enzymatic hydrolysis of said lignocellulose-containing material with enzymes having a cellulolytic and xylanolytic activity to hydrolyze said lignocellulose-containing material[,]; and ii) acid hydrolysis of said lignocellulose-containing material[, pretreatment of said lignocellulose-containing material, chromatographic separation, ion-exchange purification, precipitation, partial hydrolysis of said lignocellulose-containing material, and extraction of said lignocellulose-containing material].

26. (Amended) A method according to Claim 23 wherein said yeast is selected from the group consisting of ~~genera~~ [*Candida tropicalis*,] *Candida tropicalis* strain having an accession number ATCC 9968, and *Debaryomyces hansenii*.

30. (Amended) A method according to Claim 23 wherein:

said hexose in said [xylose-rich] xylose-containing solution further comprises arabinose[,] and said arabinose is reduced to arabinitol during said fermentation].

31. (Amended) A [method according to Claim 23 wherein:

said processing comprises] process for the simultaneous production of xylitol and ethanol from a starting material of lignocellulose-containing material, comprising:  
partially hydrolyzing said lignocellulose-containing material;  
separating said partially hydrolyzed lignocellulose-containing

material into an extracted biomass [comprising hexosans and hexoses] and a prehydrolyzate comprising free xylose;

hydrolyzing said extracted biomass to produce an hydrolyzate comprising hexose;

said fermenting comprises

fermenting said hydrolyzate to produce a fermented solution comprising ethanol; and

fermenting said prehydrolyzate to produce a fermented solution comprising xylitol; wherein substantially all of the starting material is utilized.

32. (New) A process for the simultaneous production of xylitol and ethanol from a starting material of sulphite spent liquor, comprising fermenting said starting material with a yeast strain which is capable of converting free xylose to xylitol and free hexose present to ethanol to form a fermented product comprising xylitol, ethanol and yeast, recovering the resulting ethanol and chromatographically separating a xylitol-containing fraction from the remaining fermented product, and recovery of xylitol from said xylitol-containing fraction, wherein substantially all of the starting material is utilized.

33. (New) A method according to Claim 23 wherein the starting material is pretreated.

34. (New) A method according to Claim 33 further comprising at least one of the following chromatographic separation, ion-exchange purification and precipitation.